

REMARKS

Examiner Interviews

During the prosecution of the instant case, multiple interviews were held with the previous Examiner, though no agreement was reached regarding allowable subject matter. The Applicants attempted to reach the previous Examiner to schedule another interview but were informed that the case has been reassigned to a new Examiner. The new Examiner is respectfully requested to reconsider the arguments previously filed by the Applicants, in addition to those set forth below. Additionally, the new Examiner is cordially invited to telephone the undersigned for further clarification or for any reason which may advance the case the allowance.

Rejections Under 35 U.S.C. § 103

Applicants respectfully request reconsideration of the rejections of claims 1, 6-19, 21, and 46-50, and 59-61 under 35 USC § 103(a), as being unpatentable over *Kang* (US 6,009,210) in view of *Kanade et al.* (“*Kanade*”) (US 6,151,009). As discussed in further detail below, the teachings of *Kang* and *Kanade* do not disclose each and every feature of the Applicants’ claimed invention.

Applicants’ claim 1 recites a method for processing interactive user control for a view of a scene displayed on a virtual window. A view-frustum is initially defined by a gaze projection of a location of the user’s head through outer edges of the virtual window when the location of the head is substantially normal to the center of the virtual window. The view-frustum is adjusted in accordance with the change in location of the head of the user wherein the adjusted view-frustum is defined by an updated gaze projection of the changed location of the head through the outer edges of the virtual window, such that the view-frustum moves in a direction opposite to the move in the location of the head.

One distinguishing feature of the Applicants’ claimed invention over the cited prior art lies in the manner in which the claimed view-frustum is defined and adjusted.

The view-frustum is defined by a gaze projection of the location of the head through the outer edges of the virtual window. When the user's head moves to a different location, the gaze projection is updated, thereby redefining the view-frustum as the gaze projection of the new location through the outer edges of the virtual window. Thus, when a user moves his/her head in a direction away from normal (e.g. to the left), the view frustum moves in the opposite direction (to the right).

I. The *Kang* reference fails to teach adjustment of a view-frustum by updating a gaze projection through outer edges of a virtual window.

The *Kang* reference teaches a hands-free navigation system for tracking a head and responsively adjusting the display of a virtual reality environment. *Kang* discloses the tracking of translational and rotational movements of a user's head/face. With regard to "the problem of using [the tracked movements] to control the viewing of the virtual reality environment" (Col. 8, lines 26-27), *Kang* discloses two methods.

The first method taught is "to directly use the pose parameters to determine the absolute position and orientation of the viewpoint" (Col. 8, lines 27-29). In other words, a viewpoint set within the virtual reality environment is moved in the same manner as is detected in the user's face. Thus, movement of the user's head to the left causes movement of the viewpoint to the left; rotation of the user's head in a clockwise direction causes rotation of the viewpoint in a clockwise direction, etc. The second method taught applies the same directional system, but incorporates incremental control to "indicate continuous movement within the virtual reality environment" (Col. 8, lines 32-40). In other words, positional or rotational movement of the user's head in a given direction causes continuous movement of the viewpoint in the virtual reality environment in the same manner until the user's head returns to its initial position and orientation.

Unlike the Applicants' claimed invention, *Kang* does not teach a view-frustum defined by a gaze projection through a virtual window. Rather, the effective view-frustum (which defines what the user sees on the monitor) is simply tied to the position and orientation of the viewpoint. (Though *Kang* does not in fact use the term view-frustum, Applicants apply it to *Kang* for the sake of comparison and argument.) Thus,

when the user's head moves in a given direction, the viewpoint moves with the user's head—as does the view-frustum—in the same direction.

In response to the Applicants' previously submitted arguments, the prior Examiner additionally references *Wang et al.* ("Wang") (US 5,742,263), which teaches a head-tracking system for a head-mounted display system. In particular, *Wang* teaches that as a user turns his head in one direction, the video displayed on the head-mounted system moves in the opposite direction so that the user sees what a camera would see if it panned a scene in the direction that the user is turning his head.

However, the effective view-frustum in *Wang* is again tied only to the viewpoint. So as the user turns his head, the effective view-frustum is turned in the same direction. While the *video* being displayed on the head-mounted system to the user might be described as moving in the opposite direction, this is only in order to mimic the effect of having turned the *view-frustum* in the same direction. Applicants' claimed invention is not drawn to the movement of video, but rather to the definition and adjustment of a view-frustum. *Wang* clearly does not teach the Applicants' claimed view-frustum and its adjustment.

Additionally, a direct comparison of the effects of the teachings of the *Kang* and *Wang* references to that of the Applicants' claimed invention will serve to highlight the deficiencies of the prior art. Namely, *Kang* and *Wang* teach systems which do not achieve the utility of the claimed invention, either alone or in combination.

First considering the *Kang* reference, according to one of the control methods disclosed, a view-frustum would move directly with the change in pose of the user's face. In other words, as the user looks in a given direction, so the view-frustum is adjusted to encompass that particular direction. However, this adjustment of the view-frustum would occur *independently of the display*. Assuming that a user starts with his head in front of and facing a display, if the user turned or moved his head to the right, then the view-frustum would be adjusted to the right (in the virtual world) in accordance with the direction which the user's head has turned/moved. Yet the image from the adjusted view-frustum, would still be displayed on the display, which is now to the user's left. According to *Kang*'s other control method, where a change in pose causes continuous

movement of the virtual reality viewpoint, then the view-frustum would continue to move in the direction that the user's head has moved. Yet all the while, the image from that view-frustum would be shown on the stationary display. Thus, unlike the Applicants' claimed invention, the view-frustum is wholly independent of the display.

In contrast to *Kang*, the Applicants' claimed invention defines the view-frustum in a manner which is *dependent* on the display. For the claimed view-frustum is updated based on an updated gaze-projection of the location of the user's head through the display's (the virtual window's) outer edges.

Next considering the *Wang* reference, the display is worn by the user as part of a head-mounted system, and thus moves with the user. As such, there would never be any movement of the user's head apart from the display, as their relationship is fixed, with the display moving with the user's head. Therefore, a view-frustum, the user's head, and the display would simply move in concert with one another, without any change in their relationship relative to one another.

In contrast to *Wang*, the Applicants' claimed invention specifically is directed to movements of the user's head apart from the display, and adjustment of the view-frustum accordingly. The relationship of the user's head, the display, and the view-frustum, are dynamically changing based on tracked movements of the user's head away from normal relative to the display. Unlike *Wang*, the Applicants' claimed view-frustum is dynamically updated with reference to the display based on the updated gaze projection of the user's head location through the outer edges of the display.

II. The *Kanade* reference does not cure the deficiencies of the *Kang* reference.

The *Kanade* reference teaches a method for merging real and synthetic images in real time. The Examiner cites this reference as teaching the use of a depth capturing camera. However, *Kanade* does not teach the view-frustum defined by a gaze projection through outer edges of a virtual window, or its adjustment in accordance with a change in position of a user's head as claimed. Therefore, *Kanade* does not cure the deficiencies of *Kang* as discussed above.

III. Independent claims 14, 46, 59, 61, and the dependent claims are patentable for at least the same reasons as independent claim 1.

As discussed, the cited art of record does not disclose the view-frustum and adjustment features as claimed. Therefore, for at least the reasons discussed above, it is submitted that claim 1 is patentable over the teachings of *Kang* and *Kanade*.

Independent claims 14, 46, 59, and 61 include subject matter similar to claim 1. Therefore, these claims are believed to be patentable over the cited prior art for at least the reasons discussed above with respect to independent claim 1. Likewise, dependent claims 6-12, 15-19, 47-50, and 60 are patentable for at least the same reasons as their corresponding independent claims.

Conclusion

In view of the foregoing, Applicants respectfully submit that all of the pending claims are in condition for allowance. A notice of allowance is respectfully requested.

In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (408) 774-6903. If any fees are due in connection with the filing of this paper, then the Commissioner is authorized to charge such fees to Deposit Account No. 50-0805 (Order No. SONYP029).

Respectfully submitted,
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